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ABSTRACT

ISO 9000 is one of a series of international standards providing guidelines and governing quality of products and services. The ISO 9000 certification demonstrates the capability of a supplier to control the processes that determine the acceptability of the product or service being supplied. This paper focuses on the training aspects of ISO 9000 Quality registration by reporting on an application and case study in a global organization that successfully achieved ISO 9000 Quality registration. The training system must communicate the ISO requirements to all levels of the organization and also aid performance improvement to maintain quality standards and continually improve the quality processes. The report is subdivided into the following sections: (1) ISO 9000 Overview; (2) ISO 9000 Requirements; (3) Training Requirements; (4) Case Study; (5) Role of Information Technology; and (6) Reducing Costs. The case study describes organization-wide resistance to change and how it was overcome, the formation and activities of managerial teams, and the compilation of the quality manual that is the basis for the certification audit. The benefits of the ISO certification become more apparent after certification. Achieving the standard in organizations is an indication that information flow and training are greatly improved. Implementation of the ISO standard may bring productivity improvement, a decrease in the manager/employee ratio as a result of autonomous work teams and greater responsibility given to employees, and an improved empowerment model that ensures that processes are documented and available to everyone. Instructional and information technology can facilitate the implementation of the ISO standard on a global basis. (SWC)

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Title:

The Relationship Between the Training Function and ISO-9000 Registration

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Objectives

This paper will focus on the training aspects of ISO 9000 Quality registration. The objective of this paper is to report on an application and case study in a global organization that successfully achieved ISO 9000 Quality registration. An essential element in the certification process is an appropriate training system. The training system is important in two ways. First, the communication of the ISO requirements to all levels of the organization is essential for certification. Second, the training function is important for performance improvement to maintain quality standards and continually improve the quality processes. The following content areas will be covered:

- ISO 9000 Overview
- ISO 9000 Requirements
- Training Requirements
- Case Study
- Role of Information Technology
- Reducing Costs

ISO 9000 Overview

Most organizations produce a product or service that is intended to satisfy a user's needs or requirements. Such requirements are often incorporated in specifications. Quality is traditionally measured in terms of conformance to specifications. Conformance to specifications does not guarantee that a customer's requirements are met. Quality system standards and guidelines were developed that complement relevant product or service requirements given in the technical specifications. The series of international standards, ISO 9000 to ISO 9004, embodies a rationalization of the many and various national approaches in this sphere (ISO Quality Standards Collection, 1991). The ISO 9000 standards were adopted in 1987 by the International Organization for Standardization (ISO). The ISO 9000 certification demonstrates the capability of a supplier to control the processes that determine the acceptability of the product or service being supplied (Rabbitt and Bergh, 1994).

ISO 9000's basic requirement is that there must be adequate management of whatever activities are involved in creating products (Oskarsson & Glass, 1996). The ISO standard defines and documents management's role in putting quality into a product. Product quality had traditionally been placed in the technology camp with procedures such as measuring product defects. ISO 9000 is in the quality management camp instead of the technology camp. The standard is written at a policy level with little technical advise on how to accomplish what it requires. The methods seem superficial and bureaucratic. In addition, the standard was defined by quality people. The originators knew a lot about quality, but little about the discipline to which it is applied. This issue is particularly problematic for functions like R&D and processes like software development, where the products have no weight, are created by knowledge workers and require no raw materials to produce. The standard also originated in the manufacturing world in which performance gaps in quality are measured concretely.

The basic benefit of the ISO 9000 standard is that it is a system used to measure and evaluate an organization's quality management system. Assuring customer satisfaction and gaining competitive advantage are the two main reasons for incorporating the ISO standard in a company. The ISO 9000 system uses formal audits and a registration procedure to assure customers around the world that a supplier is applying a high level quality system in producing and delivering its goods or services. These standards are now being met in companies of over 70 countries worldwide.

ISO 9000 Requirements

ISO 9000 is a family of standards and guidelines. There are different standards based on the type of business that is registered. The document ISO 9000-1 is a general guideline that gives background information about the family of standards. ISO 9001, ISO 9002, and ISO 9003 are the standards in the family, containing requirements on a supplier. ISO 9002 and ISO 9003 are subsets of ISO 9001. ISO 9002 is used for situations in which there is no design. ISO 90003 is used in situations in which there is neither design nor production (e.g. retail). Typically for both hardware and software product development, ISO 9001 is the standard to use. ISO 9004 is a comprehensive guideline to the use of the ISO 9000 standards. ISO 9004-3 is a guideline on how to use ISO 9001 for development. ISO 9004-2 is a guideline for

the application of ISO 9001 to the supply of services. It can be of interest in the context of information technology, since computer centers and other suppliers of data services can benefit from its use.

The ISO 9000 standard focuses on 20 aspects of a quality program that are subject to a rigorous audit during the certification process. Each section relates to a specific aspect of satisfying customers. These elements should be viewed in terms of how they relate to a customer's expectations. The following 20 elements are contained in section 4 of the ISO 9000 standard document.

1. *Management responsibility*
2. *Quality system*
3. *Contract review*
4. *Design control*
5. *Document and data control*
6. *Purchasing*
7. *Control of customer specified product*
8. *Product identification and tractability*
9. *Process control*
10. *Inspection and testing*
11. *Control of inspection, measuring and test equipment*
12. *Inspection and test status*
13. *Control of non conforming product*
14. *Corrective and preventive action*
15. *Handling, storage, packaging, preservation and delivery*
16. *Control of quality records*
17. *Internal quality audits*
18. *Training*
19. *Servicing*
20. *Statistical techniques*

The ISO 9000 elements must be viewed as a system. A system is a group of interacting items that form a unified relationship. A quality system is defined by the organization's management and is documented in the organization's quality system manual. The manual defines the organization's processes according to the 20 ISO elements. In general terms a quality system is defined as follows:

> *Quality System:* The organizational structure of responsibilities, procedures, processes, and resources for implementing quality management (ISO Quality Standards Collection, 1991).

ISO 9000 does not specify quality assurance standards. Those standards are defined by the organization. ISO 9000 provides a model for quality assurance that can be adapted by the organization as it sees fit. The model can only survive as an operational system if various departments in an organization continuously interact to monitor/audit the system and its effectiveness. Audits are required every year by independent outside auditors. In essence, ISO 9000 is a quality system that attempts to certify to customers that an organization will do what it says it will do in terms of determining product requirements, product development, product manufacture and product service.

Training Requirements

The standards require that staff are trained for their tasks. They further specify that the supplier to have a procedure to:

- Identify training needs for each staff position.
- Provide such training.
- Keep records of the training of all staff members.

Oskarsson and Glass (1996) highlight examples of the kinds of training an auditor would expect to see planned in software development:

- New programming languages and tools.
- Audit training for internal quality auditors.
- Project management training.

The auditor does not judge an organization's means of training and education but that the training is documented and sufficient. The criterion for sufficient training is that a person is capable of performing his/her work to a high enough standard. The auditor may see this in quality review records and project success. The records of training are essential for compliance with the standard. Examples of typical training nonconformances are:

- No procedure for planning of training.
- No training records.
- An employee who has not received proper training for his or her task.

The training procedures should start by describing how you identify training needs. This is done through the use of job descriptions or profiles. Job descriptions should detail the minimum qualifications required for assuming a position or performing a work function. The job descriptions are required as a basis for establishing a training program. The job description should state what the skill or education requirements are for a particular job. Documentation also needs to exist for each individual indicating whether they meet the job requirements. It is not always possible for every new employee hired or promoted to be trained in every aspect of a job the moment they begin. In these situations, a formal plan should be developed indicating that training will be completed in a reasonable amount of time. Randall (1995) suggests developing a training needs matrix showing the departments in an organization on one axis and the ISO element on the other axis with checks in the matrix indicating that a particular department undergo more detailed training in a particular ISO element.

Documenting training programs is essential in the ISO standard. Undocumented training programs in which a large amount of information is passed verbally from one person to another do not meet the intent of the ISO requirement. This does not mean that all training must be the result of formal classroom training courses. Many companies have formalized "on-the-job" training and apprenticeship programs. These training programs must be documented and formalized to the extent that they go beyond mere tribal knowledge. Training and education techniques such as action learning need to be documented as well.

If an employee meets the requirements of a position because of their experience, it is not necessary that they participate in training that is not needed. Their experience should be documented in their training records indicating that they meet those specific requirements of the job.

Training records must document that stated qualifications have been met as "appropriate education, training and/or experience, as required." Documenting the above can be accomplished with:

- Certificates, degrees, diplomas, licenses, etc.
- Course descriptions, course outlines, together with instructor identification and qualifications to teach the assigned courses or skills.
- Letters, memos, etc., documenting experience.

Case Study

This case study involves a division of a telecommunications company that designs, manufactures and installs transmission equipment for customers in Canada, the United States, Europe and Asia. The implementation of the ISO quality system was performed in conjunction with other quality initiatives including statistical process control, continuous improvement, and process maturity/improvements. There was initial senior management support for pursuing the ISO Quality initiative, both at the corporate and divisional levels.

As with most change, the ISO 9001 implementation met with some resistance on the part of managers and employees. Resistance originated from a lack of understanding of the intent of the ISO quality management system, of information regarding the certification process, and the objectives sought. Some managers questioned the necessity of the ISO Standard, seeing it as an increase in paperwork. Others were apprehensive of the overtime work that such an implementation would require. These feelings were compounded by the variety of quality initiatives that had come and gone throughout the company.

The ISO system was implemented in phases throughout the division. First, the manufacturing location went through the ISO 9001 certification program and achieved certification with no nonconformances. The success of this initial certification was due to two factors; a small core team of less than 20 people who took responsibility of the elements, and a good project manager who was able to bring together many organizational departments for a common purpose. In addition, the manufacturing location had a strong plant manager who was very supportive of the program. Certification at this point was focused on the local level. The success of this initial effort was a good learning experience in both the process and in pulling together as a team, the functional units of the organization .

The rest of this case focuses primarily on the certification for the R&D part of the division. This aspect of the project involved many international elements because the R&D part of the division contained work groups located throughout the US, Canada, and the United Kingdom. In addition, the company had developed several improved methods of information and communications technology that were essential in implementing certification on a global scale.

The first few months of the project were a sensitization period that was necessary to convince managers, especially senior managers, of the advantages of the ISO 9001 quality system. This period was characterized by the *personal commitment* of the division's Vice President, Assistant Vice Presidents / Lab Directors at each lab. Once this commitment was achieved, a *core team* was formed. At each R&D location, team members were assigned responsibility for one or more of the 20 applicable ISO elements. In addition there was an *executive team* that spanned the corporate and divisional locations. Once the project was underway weekly video meetings as well as conference calls were established. The division also utilized a fairly extensive internal *computer network* file server system and internal e-mail system. The computer elements were essential in *sharing information* among the teams as well as providing an electronic medium to store and retrieve quality and process information needed for all locations. Having up to date current and controlled documents available to everyone is an essential feature and audit point in the quality standard. Electronic media is very important in adhering to the standard on a global basis with several geographic locations.

The development of the quality system with the associated quality manual is the first and most important step in the certification process. In this manual, the overall quality system is defined and responsibility is designated. The organization's system with respect to each of the applicable elements are defined and described. Associated documented processes are also referenced in this manual. ISO certification must be achieved through an independent auditor. There are many types of organizations that provide this type of service. Once the certification agency was selected, they visited the locations and educated the executive and core teams on the certification process. The certifier then reviews your quality manual before you go though the ISO audit. The quality manual is really the basis for your certification audit.

The development of the quality manual proved to be an interesting and time consuming part of the process. There were two issues to balance in the development of this manual. The issues were a central corporate thrust on the quality direction as well as local processes at each site. There was quite a bit of dialogue as to what processes were common and unique to each site. The result was a divisional manual as well as each site developing a manual for its unique processes. The ISO certification process is handled by each site with each location being certified. One important step in ensuring success is to have a person that is your site internal auditor so that the processes can be audited before the final audit.

A number of processes were developed and adapted as a result of the ISO process. One item that was significant to the R&D environment was requirements analysis. Documenting and communicating what the actual requirements are for a software and hardware development project was an important addition. As a result, the development process included what was called Product Development Quality Plans (PDQP's) for each major design effort. Processes were set up to review and sign off these documents with all appropriate groups. The PDQP was a link to customer requirements. The documents forced more communication with customers.

Training was essential to the certification process. There were both formal and informal elements. The independent certification audit is a test of everyone's understanding of the process as well as whether the defined processes are in place. During certification, an auditor randomly selects individuals in the organization and interviews them. They are questioned on the processes they are following, how they get access to the quality records that contain the organization's quality position, as well as the elements and processes that apply to their job. Training first addressed the ISO process itself. There was training at each site on its quality system and the process used by employees to obtain quality records. Employees also had to be trained in determining if they were accessing the most current version of documents. Training all employees to access documents electronically proved beneficial.

Training in the ISO system is also necessary to ensure that all employees are qualified to do their jobs. Prior to the ISO implementation, training completion records were kept for completed courses. There was, however, no formal process of needs assessment tied to job qualifications. The ISO system forced the division to examine jobs/position profiles and determine the requirements for each job. As mentioned above, the ISO standard does not say that every individual has to meet the requirements initially, but a training or development plan has to be in place for a person to meet those qualifications. A global curriculum committee was established to determine the needed skills in each function in each lab. The skills included both technical and personal development skills. Training profiles were developed for individuals. The training departments at each location worked with line managers to ensure that each employee completed a training profile with their manager. The profiles were signed on a hard copy by the manager and employee. The profiles were summarized by the training function to develop the overall training plan for each lab. The training plans together with other needs assessment tools helped in determining training budgets and appropriate types of instruction. The initial job descriptions, usually kept by Human Resources, are important for audit purposes. The auditor will examine the job descriptions first and then examine random employee profiles to determine if the qualifications and development plans match.

After approximately a year of effort, all R&D lab sites achieved certification on the first audit. The sites were also recertified one year later. After the first year, the division went though a massive reorganization linking marketing, product line management, and systems engineering into a common business unit to improve customer effectiveness. The certification process now expanded to include the entire business unit. The executives in this business unit viewed the ISO process as one way to establish the organizational links and teaming to achieve this business integration. The ISO process proved an effective way to do this. A successful audit was completed for the entire business unit less than six months ago. There were several initiatives established to link the R&D effort directly to customers. In a recent Core Quality Team meeting, the ISO process was recognized for its contribution to the reorganization.

Comments from the independent audit group were very positive and highlighted important elements of a quality system:

> You have a unique, integrated quality system, which is among the best I have ever seen. It is well structured, well thought-out and well applied to meet the ISO 9001 requirements.
>
> This is the first time I have seen a Design group take a lead in customer interaction by talking to customers at the early stages of the design.
>
> Your Quality System Reviews (QSRs) are truly impressive in the fact that it covers the entire scope of the Business Indicators.
>
> You have effectively applied the Quality System to clarify Roles and Responsibilities between ... functional groups.

The important themes were linking of functional groups and the link to the customer. Training can have a role in this effort by designing learning experiences that link the business group to the customer. In this particular division, seminars and field trips are made to customer sites as often as possible to help firm up the link to the customer.

Role of Information Technology

The ISO standard really is a method of information exchange. It is a method for documenting processes to empower everyone in an organization to meet customer expectations. The role of information technology proved essential to this communication. Documents were continually developed, reviewed, and electronically exchanged, in an information network. The electronic file storage provided the required vintage control so that everyone worked from the same version. One factor that must be considered in utilizing this type of information network is the selection of the software and hardware platforms. In this case, framemaker was used for all ISO documents because it could be sent through a variety of computer hardware platforms such as Macintosh, DOS, and UNIX without many conversions and reformatting. Another lesson learned through this process was designing for useability by all employees on the network servers as well as providing training on accessing information.

Reducing Costs

Implementing the ISO process during major budget cuts in an organization is a challenge, particularly when it is done globally. As mentioned previously, utilizing video meetings and conference calls will reduce the needs for travel. An important method that will help to keep costs to a minimum is to develop and keep processes as simple as possible while still meeting the intent of the standard. Realize that processes will change and will be revised. In terms of training, an extensive curriculum based system is costly. Training is becoming more performance based. Performance analysis should be done with employees. There may also be a need for basic competencies training in addition to performance issues.

Hale and Westgaard (1995) outline some simple steps in process development that impact the budget:

- Agree what the steps are.
- Reach consensus on what steps are necessary.
- Specify what resources (e.g., time, equipment, information) each step of the process and the process as a whole require.
- Evaluate which resources add value, are used well, are redundant, or reduce quality.
- Determine cycle time.
- Agree on what information is required and what is nice to know.
- Come to consensus about how information is used, where it comes from, and what information is missing, late, or complete.

The cost for ISO certification is mainly internal except for the expense of the independent auditor. The typical cost for the independent audit group, for the initial certification, is approximately 25K and approximately 10K per year after that. The above case was for a location of approximately 300 people. The external auditor goes through all the quality records, thus how well these records are organized will impact cost. The internal cost consisted of approximately a dozen people spending 10-20 percent of their time on the ISO process. Training and understanding in the ISO standards will minimize this expense.

Conclusion

The benefits of the ISO certification become more apparent after certification. Employees begin to realize later that the ISO process will actually simplify their work (Todorov, 1996). Achieving the standard in organizations is an indication that information flow and training are greatly improved. Ultimately, there is a decrease in functional defects in a company, a reduction of nonconformity's, and greater discipline in process execution.

There have been instances where productivity improvements have been documented due to the ISO standard. The management model proposed by the ISO standard may in some cases permit a decrease in the manager/employee ratio as a result of autonomous work teams and greater responsibility given to employees. By empowering people, senior management is relieved of the management of daily activities and can concentrate on more strategic aspects of the business. The ISO standard provides this improved empowerment model by ensuring information on the companies quality system, customer links, and processes are documented and are available to everyone. Employees have at their disposal concrete tools (training, work instructions, forms, etc.) to perform quality work (Todorov, 1996). Instructional and information technology can facilitate the implementation of the ISO standard on a global basis.

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